

## **2. WORK SITE BACKGROUND**

This section provides an overview of the history, location, and previous facility activities at the work site. Previous investigation data results are presented to characterize site conditions.

### **2.1 Work Site Description and Background**

#### **2.1.1 Description and Historical Background**

The INEEL is a U.S. government-owned test site, managed by the DOE, and located in southeastern Idaho, 51.5 km (32 mi) west of Idaho Falls, as shown in Figure 2-1. The laboratory encompasses approximately 2,305 km<sup>2</sup> (890 mi<sup>2</sup>) of the northeastern portion of the Eastern Snake River Plain. The Eastern Snake River Plain is a relatively flat, semiarid sagebrush desert with predominant relief manifested either as volcanic buttes jutting up from the desert floor or as unevenly surfaced basalt flows or flow vents and fissures (DOE-ID 1999a). Elevations on the INEEL site range from 2,003 m (6,572 ft) in the southeast to 1,448 m (4,750 ft) in the central lowlands with an average elevation of 1,516 m (4,975 ft). Drainage within and around the plain recharges the Snake River Plain Aquifer, which flows beneath the INEEL and the surrounding area (DOE-ID 1997). The top of the aquifer slopes from about 61 m (200 ft) below the surface at TAN to about 183 m (600 ft) below the surface at the Radioactive Waste Management Complex. The aquifer is overlain by lava flows and sediment (DOE-ID 1999a).

The U.S. Atomic Energy Commission initially established the facility in 1949 as the National Reactor Testing Station for nuclear energy research and related activities. In 1952, the facility was expanded to accept shipments of transuranic radionuclides and low-level waste and was named the Idaho National Engineering Laboratory in 1974. In 1997, the Site was renamed the INEEL to reflect its expanded mission to include a broader range of engineering and environmental management activities. Currently, the INEEL is primarily used for nuclear research and development and waste management (DOE-ID 1999a).

In November 1989, the EPA placed the INEEL on the *National Priorities List of the National Oil and Hazardous Substances Pollution Contingency Plan* (54 Federal Register [FR] 48184) because of confirmed contaminant releases to the environment. In response to this listing, the Agencies, comprised of the DOE, EPA, and the Idaho Department of Environmental Quality, negotiated an FFA/CO and action plan. The FFA/CO and action plan were signed in 1991 by the Agencies, thereby establishing the procedural framework and schedule for developing, prioritizing, implementing, and monitoring response actions at the INEEL in accordance with CERCLA, Resource Conservation and Recovery Act (RCRA), and the Idaho Hazardous Waste Management Act (DOE-ID 1991).

To better manage cleanup activities, the INEEL was divided into 10 WAGs. Test Area North is designated as WAG 1, which includes the TSF, the Initial Engine Test (IET) Facility, the Loss-of-Fluid Test (LOFT) Facility, the Specific Manufacturing Capability Facility, the Water Reactor Research Test Facility fenced areas, and the immediate areas outside the fence lines (DOE-ID 1999a).

Located in the north-central portion of the INEEL, as shown in Figures 2-1 and 2-2, TAN was constructed between 1954 and 1961 to support the Aircraft Nuclear Propulsion Program, which developed and tested designs for nuclear-powered aircraft engines until the research was terminated by Congress in 1961. The area's facilities were then converted to support a variety of other DOE research projects. From 1962 through 1986, the area was principally devoted to the LOFT Facility, which was used to perform reactor safety testing and studies. Beginning in 1980, the area was used to conduct research and

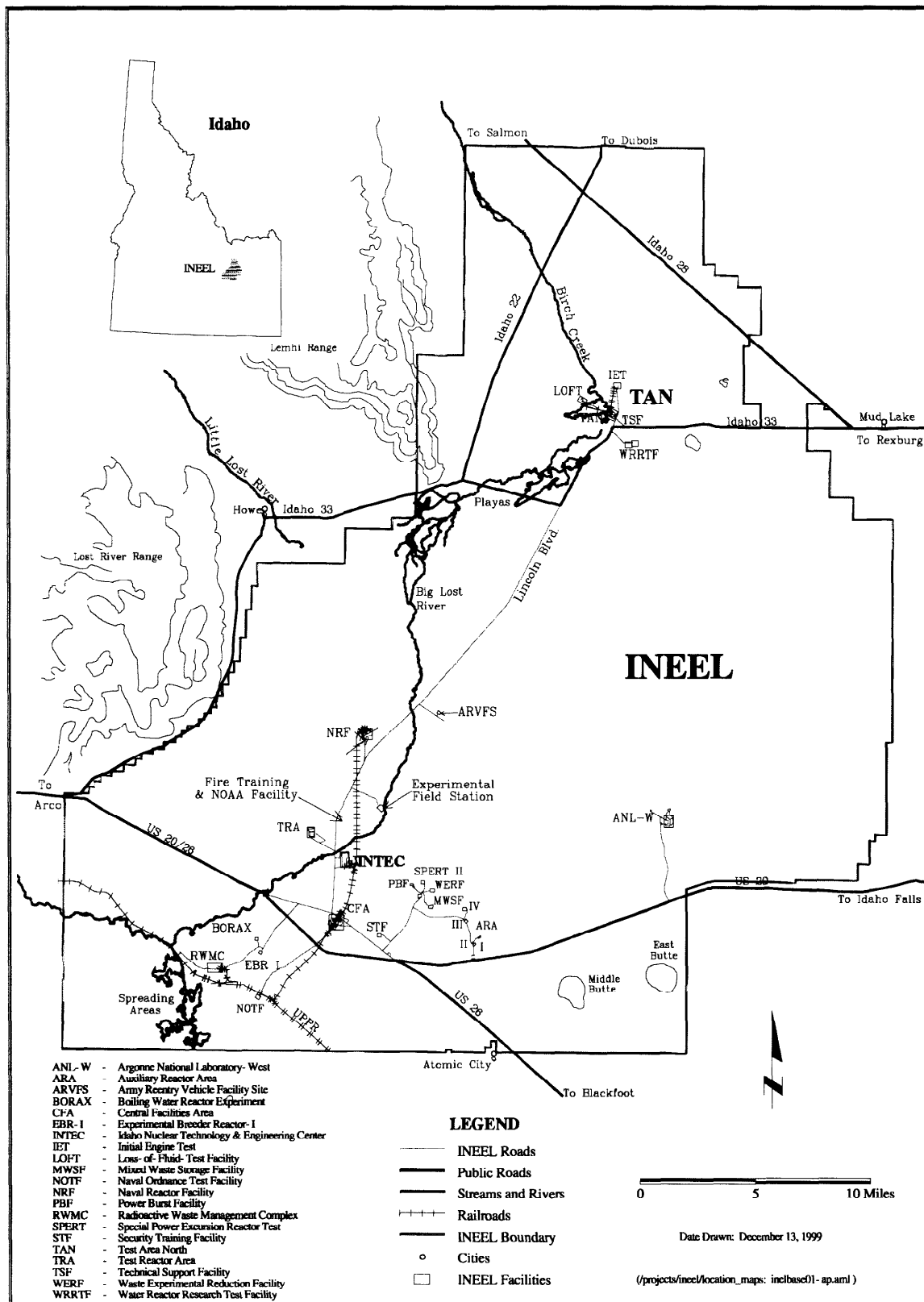


Figure 2-1. Location of Test Area North at the INEEL.

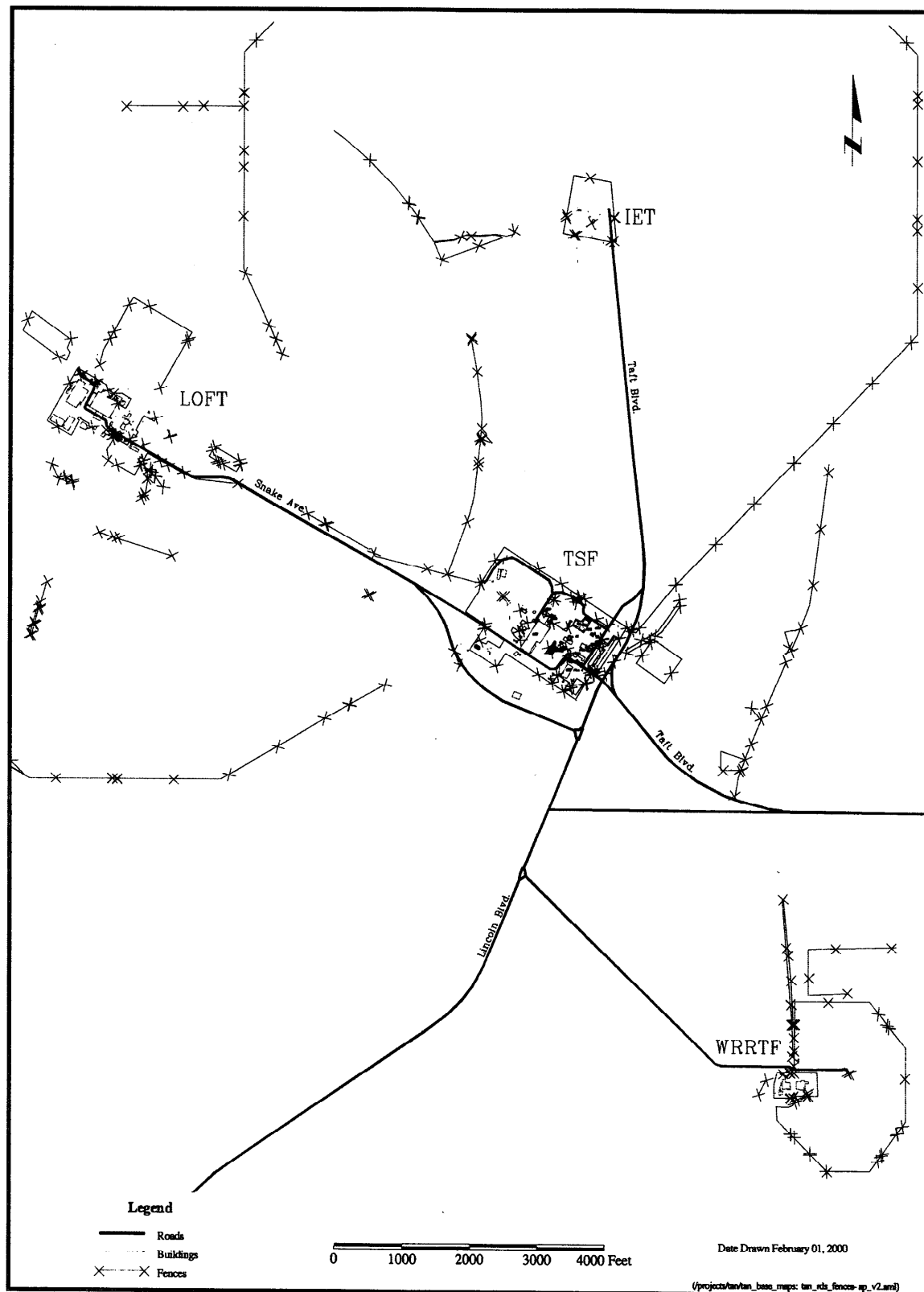


Figure 2-2. Test Area North facilities.

development with material from the 1979 Three Mile Island reactor accident (DOE-ID 1997). During the mid-1980s, the TAN Hot Shop (DOE-ID 1999a) supported the final tests for the LOFT program. Current activities include the manufacture of armor for military vehicles at the Specific Manufacturing Capability Facility and nuclear inspection and storage operations at TSF and Water Reactor Research Test Facility. The IET Facility is currently being deactivated, decontaminated, and decommissioned by the INEEL Deactivation, Decontamination, and Decommissioning program.

In 1991, the FFA/CO established 10 OUs within WAG 1, consisting of 94 potential release sites (DOE-ID 1997). The sites include various types of pits, numerous spills, ponds, aboveground and underground storage tanks (USTs), and a railroad turntable. A comprehensive remedial investigation/feasibility study (RI/FS) was initiated in 1995 to determine the nature and extent of the contamination at TAN. The FFA/CO defines OU 1-10 as the comprehensive WAG 1 RI/FS (DOE-ID 1997), which culminated with the OU 1-10 ROD. Final remediation goals (FRGs) were established in the ROD based on long-term risks associated with Cs-137 activity. This FSP primarily details the soil sampling activities to be conducted following excavation and removal of the OU 1-10 V-Tanks (TSF-09 and TSF-18).

### **2.1.2 TSF-09 and TSF-18 V-Tanks**

The TSF Intermediate-Level (Radioactive) Waste Disposal System (TSF-09) and the TSF Contaminated Tank southeast of Tank V-3 (TSF-18) are situated in an open area east of TAN-616 and north of TAN-607, as shown on Figures 2-3 and 2-4. TSF-09 consists of three abandoned USTs, and TSF-18 consists of one abandoned UST and a concrete sand filter (described below). The V-Tanks (V-1, V-2, V-3, and V-9) at TSF-09 and TSF-18 were installed in the early 1950s as part of the system designed to collect the following for treatment:

1. Radioactive liquid effluents generated in the hot cells, laboratories, and decontamination facilities at TAN
2. Waste from the IET Facility.

Based on process knowledge and work site use, the RI/FS concluded that the known or suspected types of contamination at the work sites include metals (barium, cadmium, chromium, lead, mercury, and silver), volatile organic compounds (VOCs) (trichloroethene, 1,1,1-trichloroethane, carbon tetrachloride, and acetone), semivolatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), and radionuclides (Cs-137, Co-60, Sr-90, and various isotopes of plutonium and uranium) (DOE-ID 1997).

### **2.1.3 TSF-09, Tanks V-1, V-2, and V-3**

The history and uses of the TSF-09 Tanks, referred to as Tanks V-1, V-2, and V-3, are better documented than the history and uses of Tank V-9. Since their installation, the three 37,850-L (10,000-gal) tanks have been used to store radioactive liquid wastes generated at TAN. The waste collected in the tanks was treated in the evaporator system located in TAN-616. Treatment residues were sent to the TSF injection well or the PM-2A Tanks at TSF-26. After the evaporator system in TAN-616 failed in 1970, waste stored in the TSF-09 Tanks was sent directly to the PM-2A Tanks. After 1975, waste that had accumulated in the TSF-09 Tanks was pumped out and shipped to the Idaho Chemical Processing Plant by tanker truck. Spills during tank operation and runoff from an adjacent cask storage pad reportedly contaminated surface soils surrounding the tank. In 1968, a large quantity of oil was discovered in Tank V-2, and it was taken out of service. The oil was removed from Tank V-2 in 1981, and the liquid in the three tanks (V-1, V-2, and V-3) was removed in 1982. During removal of the liquid,

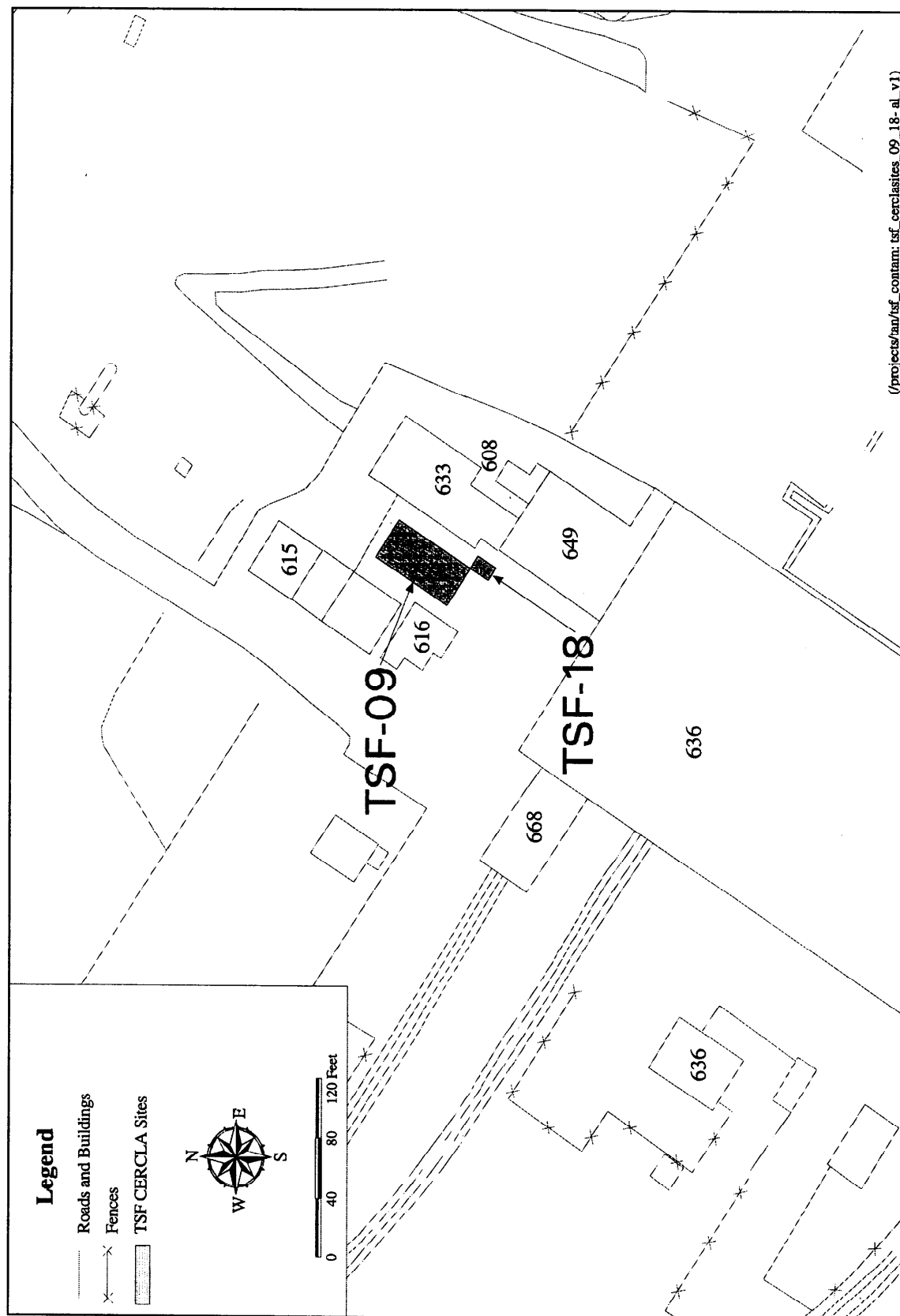
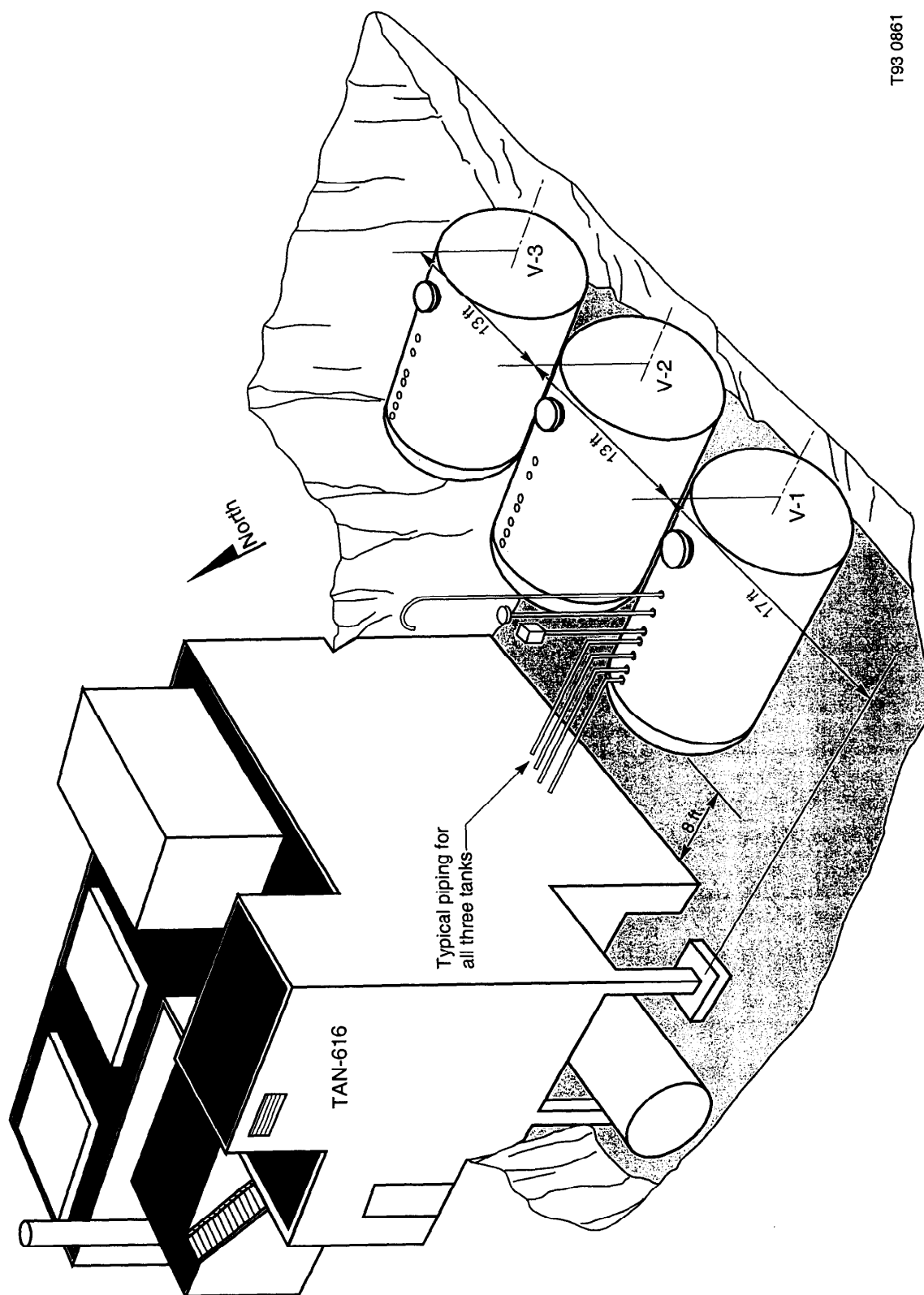


Figure 2-3. Locations of Tanks Sites TSF-09 and TSF-18.



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Figure 2-4. Diagram of Tanks V-1, V-2, and V-3.

approximately 6,434.5 L (1,700 gal) were accidentally allowed to drain onto the ground. The liquid puddled in a soil depression along the west side of the tank manways and flowed north out of the radiologically controlled area through a shallow ditch. Cleanup operations removed approximately 3.8 m<sup>3</sup> (128 ft<sup>3</sup>) of radioactive soil in a 0.9-m<sup>2</sup> (10-ft<sup>2</sup>) area north of the tanks and outside the posted radiological control zone, and the excavation was backfilled with clean soil. There are no indications that clean soil was placed in the area around the tanks following the spill. The tanks have not been used since the 1980s, although liquids (i.e., rainwater and snowmelt) have accidentally accumulated in Tank V-3 since the 1980s (DOE-ID 1997).

The TSF-09 stainless steel tanks are 3 m (10 ft) in diameter and 5.5 m (18 ft) long. Buried approximately 3 m (10 ft) below grade, the tanks have 50.8-cm (20-in.) manholes that are accessible through 1.8-m (6-ft) diameter culverts installed in 1981. Valve indicators that control flow to and from the three tanks were verified as closed, although the valves themselves have not been physically checked, due to high radiation fields existing in the building where the valves are located (TAN-616). In 1999, when rising liquid levels were measured in Tank V-3, a gasket was installed in the manhole to prevent the suspected infiltration of snowmelt and rainwater through the manhole.

#### **2.1.4 TSF-18, Tank V-9**

The tank at TSF-18, referred to as Tank V-9 (see Figure 2-5), is a 1,514-L (400-gal) stainless steel sump tank located approximately 2.1 m (7 ft) to 4.2 m (14 ft) below ground surface, which is accessible by a 15.2-cm (6-in.) diameter riser that extends to the ground surface. The conical tank is 42 in. in diameter in the center and extends approximately 2.1 m (7 ft) down to the tip of the cone. On the basis of information obtained during the remedial investigation, the tank contains approximately 0.9 m (3 ft) of sludge, 0.9 m (3 ft) of liquid, and 0.3 m (1 ft) of headspace. Blackmore (1998) estimated that the total volume of material in Tank V-9 was 1,216 L (320 gal). Radiation readings in the tank range from 9 mrem/hr on contact just inside the 15.2-cm (6-in.) riser to 10,500 mrem/hr just inside the tank. The tank was installed in the early 1950s and was indicated as a sump tank in facility “as-built” drawings. The visual evidence collected during the remedial investigation is consistent with the tank configuration shown in earlier “as-built” drawings (DOE-ID 1997).

Results from sampling and analysis of Tank V-9’s contents performed during the remedial investigation indicate that chemicals in the tank are very similar to those found in the tanks at TSF-09. High concentrations of Sr-90, Cs-137, Co-60, and trichloroethene detected during analysis are consistent with those found in the TSF-09 tanks during the Track 2 investigation in 1993. Internal visual evidence obtained with a remote camera during the remedial investigation indicates that the tank is in good condition (DOE-ID 1997). Eight additional samples were collected from Tank V-9 in May 2001 and analyzed for uranium isotopes and toxicity characteristic leaching procedure (TCLP) metals, including mercury. Data from this sampling activity will be used to further address criticality concerns and will be included in the RD/RA WP.

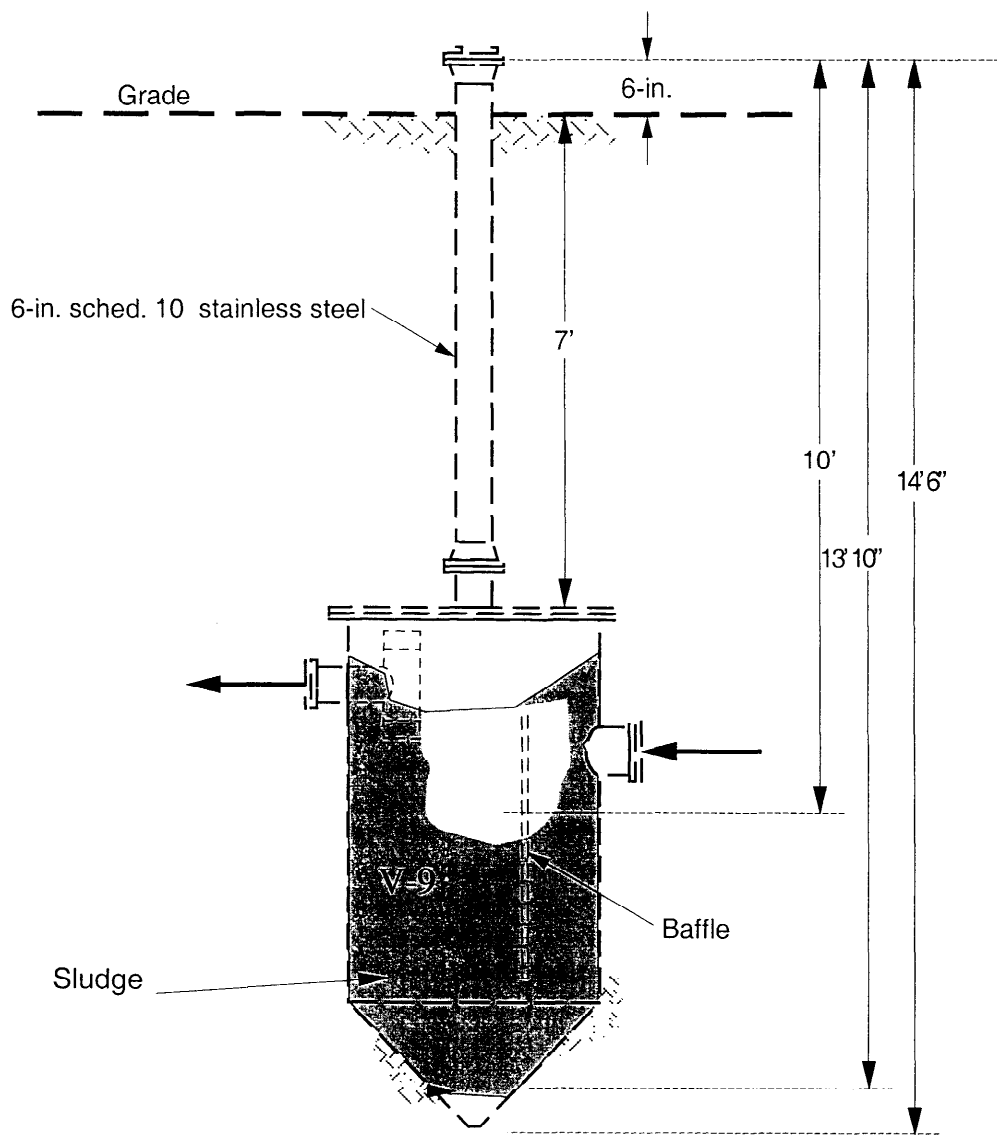


Figure 2-5. Diagram of Tank V-9.

### 2.1.5 Concrete Sand Filter

The concrete sand filter at TSF-18 is a concrete structure that is 1.5 m (5 ft) long by 1 m (3 ft) wide by 1 m (3 ft) high located aboveground approximately 0.6 m (2 ft) south of the Tank V-1 riser. Although the history and use of the sand filter are not well known, the structure is rumored to have been installed around 1970 and used for only one day before it clogged and was taken out of service. A removable lid allows access to the inside of the concrete sand filter. The sand filter was sampled in 1997 to characterize the contents, and from this sampling event, the concrete sand filter was determined to contain less than 0.03 m<sup>3</sup> (1 ft<sup>3</sup>) of material. The sampling strategy was to collect one grab sample from the center of the sand filter to analyze for total VOCs and TCLP VOCs. After the collection of the grab sample, a composite sample was collected from each of the four corners of the sand filter and the center, which was



reported to resemble a number 5 die. The composite sample was analyzed for total metals, TCLP metals, TCLP herbicides, TCLP pesticides, total SVOCs, TCLP SVOCs, and radionuclides.

Analytical results from the March 1997 sand filter sampling showed Aroclor-1260 concentrations of 290 parts per million (ppm) and gross alpha and gross beta concentrations of  $1.65 \times 10^4$  pCi/g and  $3.73 \times 10^5$  pCi/g, respectively. The radioactivity is attributed primarily to Co-60 ( $3.82 \times 10^4$  pCi/g), Sr-90 ( $1.03 \times 10^5$  pCi/g), Tc-99 ( $1.29 \times 10^3$  pCi/g), Cs-137 ( $1.09 \times 10^5$  pCi/g), and U-234 ( $2.19 \times 10^4$  pCi/g). In addition, U-235 was detected at  $6.61 \times 10^2$  pCi/g. The contaminants and concentrations detected in the concrete sand filter are similar to those detected in the V-9 Tank. A criticality evaluation performed for the sand filter documents that not enough U-235 is present to pose a criticality concern. Data tables presenting the results from the sand filter sampling are located in Appendix H of the RD/RA Work Plan.

## **2.2 Previous Investigations**

### **2.2.1 1993 Track 2 Soil Sampling**

The 1993 Track 2 investigation included the collection of eight samples from three boreholes known as Locations A, B, and C. Location A was situated just south of the valve pit next to TSF-18, Location B was just off the southwest corner of Tank V-2, and Location C was in the drainage ditch north of Tank V-3.

The soil at Location A was sampled at the surface from 0 to 0.5 ft deep, the shallow subsurface from 0 to 4 ft deep, and the deep subsurface from 20 to 24 ft deep. The soil at Location B was sampled at the surface from 0 to 0.5 ft deep and the shallow subsurface from 5 to 8 ft deep. The soil at Location C was sampled at the surface from 0 to 0.5 ft deep, the shallow subsurface from 0 to 4.5 ft deep, and the deep subsurface from 18 to 22 ft deep. Table 2-1 below presents the 1993 analytical results for Locations A, B, and C.

Results of the 1993 Track 2 investigation show that surface soil contamination ranged from 16 to 18 pCi/g gross alpha and 76 to 1,100 pCi/g gross beta. Subsurface measurements of gross alpha ranged from 9.2 to 26.0 pCi/g and gross beta ranged from 47 to 160 pCi/g. Cobalt-60 and cesium-137 were detected in the deep subsurface with maximum concentrations of 0.3 pCi/g and 103 pCi/g, respectively. The results of the inorganic analyses of samples from various intervals in the boreholes did not indicate elevated concentrations of metals at any of the depth locations. Analyses of VOCs and SVOCs show very low concentrations of acetone, trichloroethene, and Aroclor-1254.

### **2.2.2 1998 Soil Sampling**

The soils surrounding the tanks were resampled in 1998. A Field Sampling Plan (DOE-ID 1998) was prepared to direct the collection and analysis of soil samples from various WAG 1 sites, including TSF-09 and TSF-18. The objectives of the soil sampling included:

- Provide specific VOC data for identified contaminants of concern to be used as the basis to support a no-longer-contained-in determination
- Provide specific PCB data for identified contaminants of concern to be used to further support as-found concentrations of PCBs in soil
- Provide specific TCLP metals data to be used to support the statement that the soils do not contain TCLP metals at levels regulated under RCRA.

Assuming a 95% confidence upper bound level, it was determined that 12 samples would reasonably achieve the desired confidence level of 90%. Available historical data report low concentrations approaching the method detection limits. Four borehole locations were randomly chosen from a 10- by 10-ft grid. Three samples collected from discrete depth intervals were collected from each borehole. Shallow surface samples were collected at depths of 1 to 3 ft, 5 to 7 ft, and 8 to 10 ft. Subsurface samples were collected at depths of 10 to 12 ft, 14 to 16 ft, and 18 to 20 ft.

Analysis of the soil samples TCLP VOCs showed nondetect for all analytes. PCB analyses were also nondetect for all samples. TCLP metal analyses were qualified as nondetect or estimated. All values are below the RCRA-regulated TCLP and land disposal restriction (LDR) concentrations.

Table 2-1. 1993 Track 2 Soil Sampling Summary.

	Location A (~5 ft south of Tank V-9)	Location B (~5 ft west of Tank V-2)	Location C (~5 ft west of Tank V-1)
Surface Soil			
Gross alpha	18 pCi/g	16 pCi/g	16 pCi/g
Gross beta	210 pCi/g	1,100 pCi/g	76 pCi/g
Shallow Subsurface Soil			
Gross alpha	9.2 pCi/g	26 pCi/g	11 pCi/g
Gross beta	47 pCi/g	160 pCi/g	20 pCi/g
Cobalt-60	0.24 pCi/g	0.13 pCi/g	
Cesium-137	1.19 pCi/g	103 pCi/g	0.06 pCi/g
Barium	124 mg/kg	99.6 mg/kg	201 mg/kg
Cadmium	1.3 mg/kg	1.2 mg/kg	2.3 mg/kg
Chromium	21 mg/kg	14.2 mg/kg	25.5 mg/kg
Lead	17.3 mg/kg	26.7 mg/kg	23.5 mg/kg
Aroclor-1254	—	—	1.08 mg/kg
Deep Subsurface Soil			
Gross alpha	4.9 pCi/g	—	12 pCi/g
Gross beta	20 pCi/g	—	49 pCi/g
Cobalt-60	—	—	0.3 pCi/g
Cesium-137	—	—	22.1 pCi/g
Barium	236 mg/kg	—	253 mg/kg
Cadmium	2.4 mg/kg	—	2.7 mg/kg
Chromium	32.2 mg/kg	—	31.7 mg/kg
Lead	27.9 mg/kg	—	17.9 mg/kg
Acetone	0.04 mg/kg	—	—
Trichloroethene	0.009 mg/kg	—	0.003 mg/kg

### **3. SAMPLING OBJECTIVES**

A DQO process for V-Tanks confirmation sampling was used to determine the data required for conducting the soil confirmation sampling activities for the TSF-09 and TSF-18 V-Tank remediation. The DQO process also evaluated the data needs for disposal of the secondary waste streams. The DQO process was designed as a specific planning tool to establish criteria for defensible decision making and to facilitate the design of the data acquisition efforts (EPA 1994). As qualitative and quantitative statements, the DQOs help to ensure that collected data are of sufficient quality and quantity to achieve the objectives established in this FSP.

This FSP is used in conjunction with the QAPjP (DOE-ID 2000) to present the functional activities, organization, and QA/QC protocols necessary to achieve the specified DQOs. Together, the QAPjP and the FSP constitute the SAP for OU 1-10 V-Tank confirmation soil sampling activities.

#### **3.1 Data Needs**

Data needs have been determined through the evaluation of existing data and the projection of anticipated data requirements. Data needs were identified for waste profile development (secondary waste stream) and the evaluation of soils located on the floor of the tank excavation. A summary of the data needs is presented in Table 3-1.

As discussed in Section 2.1.1, the OU 1-10 RI/FS (DOE-ID 1997) and ROD (DOE-ID 1999a) reported the results of a baseline risk assessment that was conducted to evaluate risks to human health for both chemical and radiological contaminants. The baseline risk assessment utilized existing contaminant analytical data for the V-Tank site and identified the radionuclides Co-60, Cs-134, Cs-137, and Eu-154 as the only contaminants of potential concern. Further evaluation revealed that only Cs-137 posed a potential risk greater than 1E-04 and that the primary pathway was through external exposure of a resident after 100 years of institutional control. An FRG of 23.3 pCi/g was determined for Cs-137 by setting the target risk at 1E-04 and using the published cancer risk slope factor. Table 3-2 provides additional potential FRGs for the V-Tank site, based on radionuclides that are present in the V-Tank wastes and individual risks of 1E-04. These FRGs will be compared to the confirmatory analytical data, when available, to ensure that the total risk posed by these radionuclides is less than 1E-04.

#### **3.2 QA Objective for Measurement**

The QA objectives for measurement will meet or surpass the minimum requirements for data quality indicators established in the QAPjP (DOE-ID 2000), which provides minimum requirements for the following measurement quality indicators:

- Precision
- Accuracy
- Representativeness
- Completeness
- Comparability.

Table 3-1. OU 1-10 V-Tank Confirmation FSP data needs summary.<sup>1</sup>

Activity	Objective	Data Use	Measurement	Analytical Method
<b>DQO DECISION STATEMENT #1 – DETERMINE WHETHER THE RADIOLOGICAL ACTIVITY OF SOILS BENEATH THE EXCAVATED V-TANKS WARRANTS ADDITIONAL EXCAVATION</b>				
Using hand-held survey instrumentation (Eberline 335B GM Hand-Held Meter, or equivalent), identify areas of radiological contamination above background and flag for additional excavation.	Identify and remove contaminated soil as the initial phase of demonstrating that Table 3-2 specified FRGs have been achieved.	Data will be used to provide a preliminary indication regarding the extent of soil contamination at the base of the excavation. Recognizing that detection limits of hand-held survey instrumentation does not approach pCi/g activities stated as remediation goals, it is stressed that this data provides only a gross indication of significant contamination.	Beta and gamma radiation over a range of 0.1 mR/h to 1000 mR/h. Accuracy requirements are +15% digital display.	Energy-compensated, halogen-quenched GM tube.
<b>DQO DECISION STATEMENT #2 – DETERMINE WHETHER THE CONCENTRATION OF HAZARDOUS CONTAMINANTS IN THE SOILS BENEATH THE EXCAVATED V-TANKS WARRANTS ADDITIONAL EXCAVATION</b>				
Using hand-held survey instrumentation (MiniRae 2000, or equivalent), identify areas of elevated VOC concentrations and flag for additional excavation.	Identify and remove contaminated soil as the initial phase of demonstrating that risk-based hazardous constituent concentrations have been achieved.	Data will be used to provide a preliminary indication regarding the extent of soil contamination at the base of the excavation. VOC hot spots may also serve as an indicator for PCB contamination. Data will be used as a gross indication of significant contamination warranting additional excavation prior to characterization verification (DQO Statement 3).	Volatile organic vapors detected to low (<10) ppm concentrations. Accuracy requirements are + 20% digital display.	PID sensor with 10.6 eV lamp. Optional use of 9.8 eV or 11.7 eV lamps.
<b>DQO DECISION STATEMENT #3 – VERIFY THAT SOIL CONTAMINANTS BENEATH THE EXCAVATED V-TANKS POSE A RISK OF LESS THAN OR EQUAL TO IE-04 TOTAL RISK TO A HYPOTHETICAL RESIDENT IN 100 YEARS</b>				
Following excavation of flagged hot spots identified from DQO 1 and 2 activities, collect random and/or biased sample per this FSP from discrete depths for radionuclide, hazardous and PCB constituent analysis.	Verify soil contamination beneath the excavated V-Tanks is below risk-based remediation goals.	Data will be used to verify that radionuclide and hazardous /PCB concentrations achieve project FRGs. To date, FRG activities/concentrations are specific to Cs-137 (23.3 pCi/g) and hazardous/PCBs below detection. FRGs for St-90 and other radionuclides will be incorporated as action levels when values are specified. Similarly, hazardous/PCB concentrations necessary to achieve FRGs will be incorporated as action levels when specified.	Laboratory analysis will be performed on samples for radionuclides, hazardous and PCB contaminants. Minimum detection activities are the Table 3-2 FGRs plus an assumed 20% error.	Gamma spectroscopy for radionuclide contaminants; SW-846 methods for hazardous/PCB contaminants.
<b>DQO DECISION STATEMENT #4 – DETERMINE WHETHER V-TANK REMEDIAL ACTION SECONDARY WASTE MEETS DISPOSAL FACILITY WASTE ACCEPTANCE CRITERIA</b>				
Alternative 1: Use process and historical data to develop waste profiles for disposal.	Characterize secondary waste sufficiently to allow a determination of whether waste streams meet LDRs and can be accepted and disposed of by the contracted Treatment, Storage, and Disposal Facility.	Develop waste profiles for waste disposal.	Evaluate historical data.	No analysis required.
Alternative 2: Sample discrete secondary waste streams to develop waste profiles for disposal.	Characterize secondary waste sufficiently to allow a determination of whether waste streams meet LDRs and can be accepted and disposed of by the contracted Treatment, Storage, and Disposal Facility.	Develop waste profiles for secondary waste disposal.	VOCs, SVOCs, metals, and radionuclides	SW-846 methods, gamma spectroscopy, and alpha/beta analysis

<sup>1</sup> For additional detail on DQO decision statements, refer to Section 4.2.

Table 3-2. OU 1-10 V-Tank Potential FRGs

Radionuclide	$t_{1/2}$ (half-life in yr)	$\lambda$ (yr) <sup>-1</sup>	DF Decay Factor	HEAST 1995 SF (risk/yr per pCi/g)	FRG (pCi/g soil)
Am-241	4.32E+02	1.60E-03	8.32E-01	4.59E-09	9.12E+02
Cs-134	2.06E+00	3.36E-01	2.41E-16	5.88E-06	2.45E+15
Cs-137+D	3.02E+01	2.30E-02	7.28E-02	2.09E-06	2.29E+01
Co-60	5.27E+00	1.32E-01	4.82E-07	9.76E-06	7.40E+05
Eu-152	1.36E+01	5.10E-02	3.13E-03	4.08E-06	2.72E+02
Eu-154	8.80E+00	7.88E-02	1.45E-04	4.65E-06	5.15E+03
H-3	1.23E+01	5.64E-02	1.72E-03	0	NA
Ni-63	1.00E+02	6.93E-03	4.51E-01	0	NA
Pu-238	8.78E+01	7.89E-03	4.04E-01	1.94E-11	4.44E+05
Pu-239	2.41E+04	2.88E-05	9.97E-01	1.26E-11	2.77E+05
Pu-240	6.57E+03	1.06E-04	9.88E-01	1.87E-11	1.88E+05
Sr-90+D	2.86E+01	2.42E-02	6.30E-02	0	2.82E+03 <sup>a</sup>
U-234	2.45E+08	2.83E-09	1.00E+00	2.14E-11	1.63E+05
U-235+D	7.04E+08	9.85E-10	1.00E+00	2.65E-07	1.31E+01
U-238+D	4.47E+09	1.55E-10	1.00E+00	5.25E-08	6.63E+01

$$FRG = \text{final remediation goal} = \frac{TR}{SF \times CR \times CF \times EF \times ED \times DF}$$

TR = target cancer risk (1E - 04)

SF = external exposure slope factor (pCi - yr/g)<sup>-1</sup>

CR = contact rate (24 hr/day residential)

CF = conversion factor (1.14E - 04 yr/hr)

EF = exposure frequency (350 days residential)

ED = exposure duration (30 yr residential)

$$DF = \text{decay factor} = \frac{\left( e^{-(\lambda T_1)} - e^{-(\lambda T_2)} \right)}{\lambda \times (T_2 - T_1)}$$

$$\lambda = \text{radioactive decay constant} = \frac{\ln 2}{t_{1/2}} \text{ (yr)}^{-1}$$

$t_{1/2}$  = radioactive half - life (yr)

$T_1$  = years until beginning of exposure period (100 yr);  $T_2$  = years until end of exposure period (130 yr)

+D = indicates that cancer risk estimates for these radionuclides include contributions from short-lived decay products.

a. The FRG for Sr-90 is calculated using the HEAST 2001 value because the external exposure slope factor (SF) is reported as zero in 1995 HEAST. The updated HEAST 2001 SF used to calculate the FRG is 1.96E-08 risk/yr per pCi/g. HEAST 1995 = *Health Effects Assessment Summary Tables (HEAST)*, Table 4, EPA Office of Radiation and Indoor Air, November 1995. HEAST 1995 values are used to agree with the OU 1-10 RI/FS and ROD methodology.

HEAST '01 = *Health Effects Assessment Summary Tables (HEAST)*, Radionuclides Table, EPA Office of Radiation and Indoor Air, April 2001.

NA = Not Applicable

Precision, accuracy, and completeness will be calculated in accordance with the QAPjP. Representativeness and comparability will be promoted by the sampling design, the collection of samples using similar sampling techniques to previous efforts, and the use of the same analytical techniques as previous efforts. By promoting representativeness and comparability in this manner, the previous data set can be supplemented with the new data collected under implementation of this FSP.

### **3.2.1 Precision**

Precision is a measure of the reproducibility of measurements under a given set of conditions. In the field, precision is affected by the natural heterogeneity of the material being sampled and by sample collection procedures. Overall precision (field and laboratory) can be evaluated by the use of duplicate samples collected in the field. Greater precision is typically required for chemicals with very low action levels that are close to background concentrations.

Laboratory precision requirements are part of the validation criteria against which laboratory data are evaluated. Laboratory precision can be estimated using duplicates, spiked samples (i.e., matrix and/or surrogate spikes), and/or laboratory control samples. Laboratory precision will be evaluated during the method data validation process. The number of laboratory QC samples is specified in the analytical methods used and in the SMO SOW (or task order SOWs). Evaluation criteria for the QC samples are specified in the SMO data validation technical procedures (TPRs).

Field precision will be based on analysis of co-located field duplicate or split samples. For samples collected for laboratory analysis, a field duplicate will be collected at a minimum frequency of one for every 10 field samples. Approximately 20 soil samples will be collected for laboratory analysis. It is unknown how many samples related to secondary waste will be collected for analysis.

### **3.2.2 Accuracy**

Accuracy is a measure of bias in a measurement system. Sample preservation and handling, field contamination, and the sample matrix in the field affect overall accuracy. The effects of the first three can be assessed by evaluating the results of field blanks and equipment rinsates (i.e., equipment blanks). A rinsate is a sample of analyte-free water poured over decontaminated sampling equipment, which is designed to detect any residual contamination on the equipment.

Laboratory accuracy requirements are part of the validation criteria against which laboratory data are evaluated. Laboratory accuracy may be assessed through the use of matrix spikes, laboratory control samples, and blind QC samples, and laboratory accuracy will be evaluated during the method data validation process. The number of laboratory QC samples is specified in the analytical methods used and in the SMO SOW (or task order SOW). Evaluation criteria for the laboratory QC samples are specified in the SMO data validation TPRs.

Field accuracy will only be determined for samples collected for laboratory analysis. The requirement for collecting field and equipment blank samples sets a frequency of one for every 10 environmental samples. In addition, the requirement for equipment blank samples states that equipment blanks will be collected whenever there is a change in the sample collection procedures, sample decontamination procedures, sampling equipment, or sample collection personnel.

### **3.2.3 Representativeness**

Representativeness assesses whether information obtained during the investigation accurately represents actual conditions. Representativeness is a qualitative parameter that expresses the degree to

which the sampling and analytical data accurately and precisely reflect the characteristic of a population, the parameter variations at a sampling point, or an environmental condition. Representativeness addresses the proper design of the sampling program implemented by the FSP. For the purposes of the V-Tank sampling, collecting a sufficient number of samples to assess the confidence level of the data with respect to its intended use satisfies this criterion (INEEL 2000). Section 4 of this document describes the justification used to estimate the number of samples.

### **3.2.4 Completeness**

Completeness is a measure of the quantity of usable data collected during an investigation. The QAPjP (DOE-ID 2000) requires that an overall completeness goal of 90% be achieved during a RI/FS. For all samples required for this FSP, a completeness goal of 90% is specified.

### **3.2.5 Comparability**

Comparability is a qualitative characteristic that refers to the confidence with which one data set can be compared to another. At a minimum, comparable data must be obtained using unbiased sample designs. If sampling designs are not unbiased, the reasons for selecting another design should be well documented. For this project, the rationale for each sampling design is presented in Section 4.2.

No data have previously been collected from soil beneath the V-Tanks. Therefore, data collected under this sampling plan will not be compared to any other data set, other than correlation to confirmation samples collected to verify radionuclide activity associated with the contents.

## **3.3 Sampling Objectives**

The primary sampling objectives are defined in Table 3-1.

## **3.4 Data Validation**

Data will be acquired, processed, and controlled prior to input to IEDMS under MCP-227, "Sampling and Analysis Process for CERCLA and D&D Activities." For samples submitted to the analytical laboratory for the work acceptance criteria compliance, 10% of the definitive data collected will be validated to Level B.

The SMO will validate the data to the levels of analytical method data validation. The analytical method data validation will be conducted in accordance with TPR-80, "Radiological Data Validation" (formerly Standard Operating Procedure 12.1.2). Validated data are entered into the IEDMS and uploaded to the Environmental Restoration Information System.